The Connecticut Society of Radiologic Technologists

Affiliated with the American Society of Radiologic Technologists

Good Afternoon, Senator Harris, Representative Ritter, and members of the Public Health Committee, I am Diane Kosenko; Chairman of the Board for The Connecticut Society of Radiologic Technologists .The CSRT is the organization that represents the Radiologic Technologist in Connecticut. We are an affiliate of the American Society of Radiologic Technologists.

Our mission is to provide state of the art education, communication, and legislative representation for our society; while creating public awareness of our integrity, professionalism, and humanitarianism. The purposes of the Society is to advance the science of Radiologic Technology, to assist in establishing and maintaining high standards of education and training, to elevate the quality of patient care, and to improve the welfare and socio-economics of Radiologic Technologists.

As the affiliate of the American Society of Radiologic Technologists, CSRT believes in the promotion of, and the elevation of the quality of patient care throughout the state. We are proud to uphold that fine reputation among our medical professional peers and associates.

The CSRT has been involved with updating our state regulations, to keep the laws current with the RT's scope of practice and our continuing education requirements. Some of the over 3,000 licensed Radiographers in CT participate in educational seminars that are offered throughout the year at different locations within the state.

The health of the public can only benefit from properly certified and fully licensed radiologic personnel. No matter what the radiologic procedure, the technologist's detailed knowledge of anatomy, the precise patient positioning, the careful application of radiation and skillful operation of sophisticated medical equipment are the keys to success. All these skills are due to the education Radiographers have obtained. Competence is necessary when one individual is responsible for controlling the intensity of the beam, the duration of exposure, and the shielding of the patient.

There is a delicate balance between the amount of radiation administered in order to correctly diagnose a potential disease and the amount of radiation, which would be more dangerous than the potential disease. The National Cancer Institute estimates that the long-term effects of overexposure to radiation during diagnostic x-ray examinations alone may be responsible for more than 3,500 cancer deaths a year.

The Physician Assistants in this state are going to ask to be excluded from the Radiographers Bill Chapter 376c. The curriculum for Physician Assistants does NOT include any radiation safety, radiation protection, radiation biology, radiation production and characteristics, and patient positioning. These classes are all required of Radiographers. These are the fundamental principals in radiology. Competency in these areas must be shown before graduating, passing the American Registry of Radiologic Technologists Board Exam, and practicing in our state.

Allowing all Physician Assistants the right to operate fluoroscopy machines, which can emit 4 times the radiation of routine radiographs, while they are performing image guided procedures, without formal academic instructions, from an accredited institution of higher learning, could harm not only the patient, but also the Radiographer and other staff involved in the procedure. Having an in-service without showing competency does not prove that anyone has mastered the information.

The American Registry of Radiologic Technologists Code of Ethics. #8 "The Radiologic Technologist practices ethical conduct appropriate to the profession and protects the patients right to quality Radiologic technology care." This Code of Ethics is compromised when Radiographers work with Physician Assistants who administer ionizing radiation to patients when they are not licensed to do so. We must work within our Code and Standard 's of Ethics.

According to the National Academy of Sciences \ National Research Council's Committee on Biological Effects of Ionizing Radiation, or also known as BEIR, medical diagnostic radiology accounts for about 90% of the total man-made radiation dose to the U.S. population. They also released a report "Health Risks from Exposure to Low Levels of Ionizing Radiation" and reconfirmed their previous stance that even very low doses of radiation can cause cancer. Furthermore, they now believe that risks from low dose radiation could be even greater than previously thought.

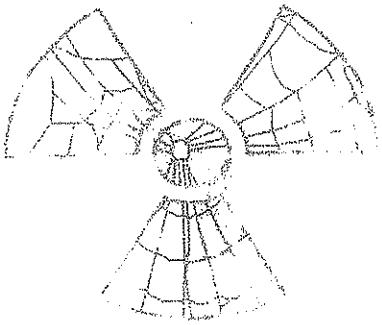
The EPA has stated that medical personnel who are always receiving radiation are also increasing their risk of cancers. The Radiologic Technologist would be in the room while a Physician Assistant utilizes the fluoroscopy equipment during an image-guided procedure. It is the CSRT concern for the well being of everyone in the radiology suite. Fluoroscopic exams are considered "Dangerous or Hazardous Procedures" by the Texas administrative Code, and PA's and RN's are not allowed to perform these procedures.

In fact, in states near us, New York, New Jersey, Delaware, and Massachusetts do not allow PA's to fluoroscope or perform image-guided procedures utilizing radiation. Other states such as Iowa, Kansas, Nebraska, Ohio, Texas, Utah, Washington, West Virginia, Wyoming, also do not allow PA's or RN's to perform diagnostic procedures, including fluoroscopy.

New Jersey has written on their Radiologic Technology Licensure states web site, "Radiation is unique in that it cannot be detected by sight, touch, smell, hearing or taste. It's proper use can save lives but its abuse may ultimately harm patients. Because of this inherent risk, it is every patient's right to have their radiographic procedure performed by licensed, knowledgeable professionals who are aware of the proper techniques and the associated risks involved in these procedures." The American College of Radiologists, states "Modern fluoroscopic equipment is capable of delivering very high radiation doses during prolonged procedures. There have been reports of serious skin injuries in some patients undergoing certain fluoroscopically guided procedures. Management of the use of radiation must also ensure adequate safety of the medical personnel involved in these procedures"

The CSRT exists to ensure that the patients of Connecticut receive the best care possible, with the lowest amount of ionizing radiation, administered by the highest educated and quality professionals. This is not an issue of "A turf war" as some have called it; this is simply an issue of safety for the patient and all personnel involved during these procedures, including the PA.

Sincerely,
Board of Directors
Connecticut Society of Radiologic Technologists



Radiation Safety Office

Henry Ford Health System

4. Case Studies of Radiation Injury

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Chapter 4: Case Studies of Radiation Injury

Non-Symptomatic Skin Reactions

Minor skin reactions caused by X-rays can be easily misattributed to other causes (e.g. sun exposure or rashes). Also, since these skin reactions are delayed effects, they typically would not be be seen in the clinic. Thus, patients and caregivers may not be aware of skin changes that can be caused by lengthy fluoroscopic procedures (Wagner 1999). The following case study is a useful example:

1. Physical examination one year following coronary angioplasty identified a 1 x 2.5 cm-depigmented area with telangiectasia on the patient's left shoulder. Total fluoroscopy time: 34 minutes.
2. One year after PTCA involving 66 minutes of fluoroscopy, a 10-cm diameter hyperpigmented area with telangiectasia was evident on the patient's right shoulder.

The above skin changes were in areas not visible to the patients and were only identified upon physical examination.

Symptomatic Skin Reactions

The circumstances leading to symptomatic radiation induced changes are varied. Case reports are grouped according to common factors in order to identify the reasons for radiation-induced effects.

PA Fluoroscopy

The posteroanterior (PA) orientation of the fluoroscope, when properly

configured with the image intensifier down close to the patient, is probably the least problematic with regard to Entrance Skin Exposure (ESE) rate. However, extended fluoroscopy usage has resulted in reports of skin damage. The following case study, which did not occur at Henry Ford Health System, illustrates this effect (Shope 1995).

On March 29, 1990, a 40-year-old male underwent coronary angiography, coronary angioplasty and a second angiography procedure (due to complications) followed by a coronary artery by-pass graft. Total fluoroscopy time estimated to be > 120 minutes. Figure 4-1 shows the area of injury six to eight weeks following the procedures. The injury was described as "turning red about one month after the procedure and peeling a week later." In mid-May 1990, it had the appearance of a second-degree burn.

Figure 4-1: 6-8 Weeks Post Procedure

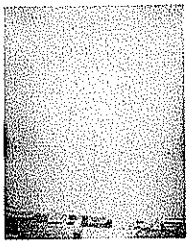
Courtesy of Wagner, 1999

Note the square pattern of the injury.

Figure 4-2 shows the appearance of skin injury approximately 16 to 21 weeks following the procedures with small ulcerated area present.

Figure 4-2: 16-21 Weeks Post Procedure

Courtesy of Wagner, 1999



Appearance of skin injury approximately 18 to 21 months following procedures, evidencing tissue necrosis:

Figure 4-3: 18-21 months Weeks Post Procedure

Courtesy of Wagner, 1999

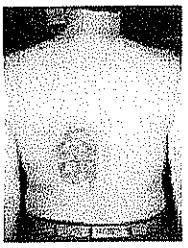


Figure 4-4 shows a close-up of injury area at 18-21 months:

Figure 4-4: 18-21 Months Post Procedure

Courtesy of Wagner, 1999

Two additional reported cases of radiation-induced injury (Wagner 1999):

1. Following a transjugular intrahepatic portosystemic shunt (TIPS) procedure involving 90 minutes of fluoroscopy, a discharged patient developed erythema and discoloration on his back. One year after the TIPS procedure an ulcer developed, which did not heal, and two years later it was 4-cm in size. A split thickness skin graft from the right buttock was performed.

2. Following a TIPS procedure lasting 6 hours and 30 minutes (no indication of total fluoroscopy time), a 16- x 18-cm hyperpigmented area developed on the patient's back and progressed over a period of several months into a central area with ulceration. After 14 months a split thickness skin graft was performed leaving a depressed scar at the surgical sight.

These case studies indicate that extensive use of fluoroscopy can induce severe skin damage, even under the most favorable geometries.

Steep Fluoroscopic Angles

When the fluoroscope is oriented at a lateral or an oblique angle, two factors combine to increase the patient's ESE rate. The first is that a thicker mass of body tissue must be penetrated. The second is that the skin of the patient is closer to the source because of the wider span of anatomy (Wagner 1999). Example cases are given below:

1. A PA oblique angle using a C-arm involved 57 minutes of fluoroscopy. Twenty-four hours later the patient reported a stabbing pain in his right thorax. Three days later an erythema developed which evolved into a superficial ulcer. At two and half months after the procedure the area was approximately 12-cm x 6.5-cm and described as a brownish pigmented

area with telangiectasia, central infiltration and hyperkeratosis.

4. A PA oblique angle was employed during a catheter ablation procedure involving 190 minutes of fluoroscopy. A symptomatic discoloration was noted several days after the procedure on the patient's left upper back. In the next few weeks the area had become painful and was draining. At seven weeks the area was approximately 7- x14-cm in size and described as a rectangular erythema with ulcers. After treatment, there was a gradual lessening of tenderness with reepitherlialization, leaving a mottled slightly depressed plaque.
5. A steep PA oblique angle through the right shoulder was employed involving 51 minutes of fluoroscopy. Fourteen days after the procedure, an erythema appeared on the right shoulder that progressed into moist superficial ulcer with poor healing. This degenerated into a deep muscular ulcer requiring a myocutaneous skin graft approximately 14 months after the procedure.

The temporal progressions of these effects are consistent with high levels of acute exposure to x-ray radiation. The temporal differences in the responses are due in part to the levels of radiation received, but are also likely due to variations in radiation sensitivity amongst the patients.

Multiple Procedures

Although intervals between procedures should permit the skin to recover, healing might not be complete. This may lower the tolerance of the skin for further procedures (Wagner 1999). Example cases are given below:

1. A patient underwent two PTCA procedures about one year apart. Skin changes appeared approximately three weeks after the second procedure. At seven weeks a cutaneous ulcer had developed over the right scapula and healed without grafting.
2. A patient underwent two unsuccessful cardiac ablations involving approximately 100 minutes of fluoroscopy in a lateral oblique orientation. Approximately 12 hours after the second attempt, an erythema developed in the right axilla. At one month the area was red and blistering. At two years the area was described as a 10 x 5cm atrophic indurated plaque with lineal edges, hyper- and hypopigmentation, and telangiectasia. The patient was described as having difficulty raising her right arm.
3. Three PTCAs were performed on the patient, the last two completed on the same day approximately 6 months after the first procedure. The total fluoroscopy time was approximately 51 minutes. Erythema was noted immediately after the last procedure. This progressed from a prolonged erythema with poor healing into a deep dermal necrosis. The patient underwent a successful split thickness skin graft two years after the last procedure.
4. Past treatment of pulmonary tuberculosis often resulted in many patients undergoing extensive exposure to fluoroscopy. These patients had a demonstrated high incidence of breast cancer.

Previous procedures can lower the skin's tolerance for future irradiation. Prior to commencing any lengthy fluoroscopic procedure, the patient's medical history should be reviewed. The skin of the patient should be examined to

ascertain if any skin damage is apparent should the patient have a history of lengthy fluoroscopic examinations. Direct irradiation of damaged areas should be avoided when possible.

Positions of arms

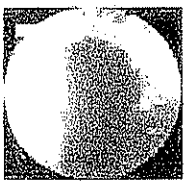
Keeping arms out of the x-ray beam during some procedures can be a difficult. Careful attention must be given to providing the arms with a resting position that will not restrict circulation but will at the same time maintain the arms in an area that is outside the radiation field (Archer 2000).

A middle-aged woman had a history of progressively worsening episodes of arrhythmia. A radiofrequency electrophysiological cardiac catheter ablation was scheduled to treat the condition. The procedure employed 20 min of beam-on time for each plane of a bi-plane fluoroscope. Prior to the procedure the separator or spacer cone was removed so that the fluoroscopic c-arms could be easily rotated around the patient. The spacer cone is a spacer attached to the tube housing designed to keep the patient at a reasonable distance from the x-ray source. This is done specifically to avoid the high skin-dose rates that can be encountered near the tube port.

The patient's arms were originally placed at the patient's side but the right arm later fell into a lower position directly in front of this x-ray tube. However, personnel were not aware of this change because sterile covers were draped over the patient and did not correctly interpret the image (Figure 4-4). The right humerus was directly in the beam at the port. Because the separator cones were removed, the arm was only about 20–30 cm from the focal spot. With the soft tissue and bone of the arm directly in the beam, the automatic brightness control drove the output to high levels at the surface of the arm. The cumulative dose probably exceeded 25 Gy (2500 rad). This procedure was not performed at Henry Ford Health System.

Figure 4-4: Image of Arm resting on X-ray Tube Port

Courtesy of Archer, 2000



The patient was released from the hospital the day after the procedure. At the time there were no complaints regarding her arm and no indication of erythema. About three weeks after the procedure, a bright erythema was demonstrated (Figure 4-5).

Figure 4-5: Three weeks Post Procedure

Courtesy of Archer, 2000

The condition worsened and at five months a large ulcer the size of the collimated x-ray port developed.

Figure 4-6: Five Months Post Procedure

Courtesy of Archer, 2000

The separator or spacer cone ensures that a minimal distance between the X-ray source and the patient is maintained (inverse square law effects). For some X-ray machines, the spacer cone is designed to be removable in order to provide more flexibility in positioning for some special surgical procedures (e.g., portable C-arms). There is a risk of very high dose rates to the skin surface when it is removed.

Skin Sensitivity

Some patients may be hypersensitive to radiation due to pre-existing health conditions (Wagner 1999).

Erythema developed after diagnostic angiography and liver biopsy. Skin necrosis requiring rib resection evolved in the same patient after a TIPS procedure. The wound remained open for five years before a successful cover was put in place. Investigation into the events revealed that the patient suffered from multiple problems, including Sjøgren's syndrome and mixed connective tissue disease.

Injuries to personnel

The following are modern-day examples of how improper use of the fluoroscope can lead to injuries in personnel (Wagner 1999).

1. Hands of physicians have incurred physiologic changes indicative of high cumulative doses of chronic low-dose-rate irradiation. Brown finger nails and epidermal degeneration are typical signs. These changes were the result of years of inserting hands into the x-ray field with the x-ray tube above the patient.
2. Four cases of radiation-induced cataract have been reported in personnel from procedures utilizing the x-ray tube above the patient orientation.

Doses accumulated to hands and eyes from frequently using the fluoroscope with the tube above the patient can be extremely high. Only routine application of proper radiation management techniques will be effective at avoiding such high doses.

Go to Chapter 5_Protection Methods